Prospective functional and clinical comparison of bilateral ReZoom and ReSTOR intraocular lenses in patients 70 years or younger

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PURPOSE: To compare clinical outcomes, functional vision, and spectacle freedom in patients 70 years or younger with bilateral ReSTOR (Alcon Laboratories) or ReZoom (Advanced Medical Optics) intraocular lenses (IOLs).

SETTING: Private practice, Los Altos, California, USA.

METHODS: Thirty patients had nonrandomized bilateral implantation of a ReZoom or ReSTOR multifocal IOL. Patients were 70 years or younger with operable bilateral cataracts and otherwise healthy eyes. Outcome measures recorded 6 months postoperatively were uncorrected (UCVA) and distance-corrected (far, intermediate, near) visual acuities, contrast sensitivity (photopic, mesopic, mesopic with glare), pupil size, and stereopsis. Patients completed a quality-of-life questionnaire and an interactive functional evaluation using real-life props.

RESULTS: The UCVA at all distances was excellent in both groups, with the ReSTOR IOL performing significantly better at 31 cm. This near superiority was also evident with distance correction or at the patient's preferred reading distance and correlated with subjective and functional vision testing results. Intermediate vision at 50 cm was comparable. The incidence of halos was similar; however, severity was higher in the ReZoom group, with 2 of 15 patients refusing a second IOL for this reason. Spectacle freedom was achieved by 50.0% in the ReZoom group and 72.7% in the ReSTOR group.

CONCLUSIONS: Both multifocal IOL designs provided excellent UCVA. ReSTOR patients had better clinical and functional vision at near and comparable clinical and functional intermediate performance. Halos were more severe in the ReZoom group. Although the ReSTOR IOL gave higher rates of spectacle freedom, patient satisfaction was high in both groups.

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After its approval by the U.S. Food and Drug Administration (FDA) in 1997, the Array (Advanced Medical Optics) remained the only multifocal intraocular lens (IOL) available in the United States until 2005, when 2 new multifocal IOLs simultaneously became available to U.S. surgeons and their patients.

The AcrySof ReSTOR SA60D3 apodized diffractive multifocal IOL (Alcon) was approved in March 2005. The optic consists of 2 components: a central 3.6 mm area of diffractive discontinuities that result in an effective addition (add) of +4.0 diopters (D) at the IOL plane and +3.2 D at the spectacle plane and a refractive surface extending from the center to the 6.0 mm edge for distance vision. Also approved in March 2005 was the ReZoom NXG acrylic multifocal IOL (Advanced Medical Optics). This second-generation zonal-progressive refractive IOL was modified from the Array design. The IOL has 5 alternating optical zones with aspherical transitions. Zones 1 (the center), 3, and 5 are weighted for distance, while zones 2 and 4 are weighted for near focus. Compared with the Array IOL, the ReZoom is of hydrophobic acrylic material and is designed to decrease glare and halos. The near add is +3.2 D at the IOL plane and approximately +2.6 D at the IOL plane.

Various studies report the clinical outcomes with these lenses (AcrySof ReSTOR IOL Clinical Results. Available at: http://www.acrysofrestor.com/acrysof-restor-iol/restor-clinical-studies.asp. Accessed February 5, 2008).[1–9] However, although distance, intermediate, and near acuity are important as objective measures, their correlation with real-life function is not always clear. Furthermore, many additional factors determine patient satisfaction. These include functional vision

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(with and without correction), optical and visual quality, unwanted optical images, and patient expectations. Unlike with the Array IOL, patient satisfaction may also be influenced by the significant out-of-pocket expense necessary to receive these IOLs.

This prospective single-surgeon study analyzed and compared the clinical performance of these 2 multifocal IOL designs in a standardized fashion. In addition to uncorrected (UCVA) and best corrected (BCVA) visual acuity at different distances, distance-corrected near and intermediate acuities were measured to compare the intrinsic pseudoaccommodative properties of each IOL. In addition to objective acuity measures, a quality-of-life questionnaire was used to assess spectacle independence for several common daily activities. The result was correlated with standardized testing of functional vision administered in the office using real-life props.

Only patients with bilateral implantation who were 70 years or younger with healthy eyes were enrolled. This arbitrary age cutoff was chosen to select patients who were likely to be more demanding than older cataract patients in terms of visual function and lifestyle. Because nighttime glare and halos are inherent in multifocal IOL designs, it was especially desirable to evaluate a younger patient population that was more likely to be active at night. Finally, patient function and satisfaction were not assessed until 6 months postoperatively to allow patients adequate time to adapt to their new visual system and to unwanted optical images.

PATIENTS AND METHODS

One unmasked site prospectively enrolled 30 patients for bilateral implantation of a ReZoom IOL (15 patients) or ReSTOR IOL (15 patients). All patients signed a written consent form that, along with the study design, was approved by the institutional review board. All patients were 70 years or younger with bilateral operable cataract and otherwise healthy eyes. All patients had 1.0 D or less preoperative astigmatism, and astigmatic keratotomy performed simultaneously with cataract surgery was permitted at the surgeon's discretion.

The choice of multifocal IOL was not randomized. Instead, the investigator selected the multifocal IOL to be implanted based on the individual's stated functional objectives, his or her customary reading distance, and ocular factors such as pupil size. The investigator personally counseled patients about their IOL options and the functional expectations. All patients expected to have bilateral implantation with the same IOL; mixing dissimilar models was not permitted. All patients paid an additional out-of-pocket fee for the multifocal IOL, which was not covered by health insurance. Biometry was performed using IOLMaster partial coherence interferometry (Zeiss), and keratometry was performed with a Topcon autokeratometer. The first 15 patients with bilateral implantation of the ReZoom or ReSTOR IOL to meet the inclusion criteria were consecutively enrolled in the study. The investigator had had no experience with either IOL; thus, these represented his first bilateral ReZoom and ReSTOR patients 70 years or younger.

A standardized surgical technique, including topical anesthesia and a sub-3.0 mm temporal clear corneal incision, was used in all eyes. After phacoemulsification was performed using a chopping technique, the foldable IOL was placed in the capsular bag through a capsulorhexis with a diameter that was approximately 0.5 mm smaller than the optic diameter. The refractive target was emmetropia. The standardized postoperative medication protocol included a topical antibiotic, steroid, and nonsteroidal antiinflammatory drug.

Intraocular lens implantation occurred within 35 days of the preoperative visit. Three postoperative visits were completed. These visits occurred 1 day postsurgery as well as 30 ± 7 days and 4 to 6 months after IOL implantation in the second eye.

Visual acuity testing was performed with an Early Treatment Diabetic Retinopathy Study chart. The uncorrected (UCVA) and best corrected distance visual acuities, uncorrected and distance-corrected intermediate visual acuities at 50 cm, and uncorrected and distance-corrected near visual acuities at 31 cm were measured preoperatively and postoperatively. A 31 or 50 cm long string attached to the near card was used to guide placement at the appropriate test distance. The uncorrected and distance corrected near acuities were also measured at the distance at which the patient felt he or she could best read the test card. This was designated as the patient-preferred reading distance. Distance-corrected acuities were all measured with the patient wearing best distance correction to simulate emmetropia. Measurements were taken binocularly with the exception of monocular testing of the first study eye 1 week after IOL implantation in the first eye. LogMAR visual acuity scores were converted to Snellen equivalents for reporting.

Best distance-corrected contrast sensitivity testing was performed 6 months postoperatively under 3 lighting conditions: photopic, mesopic, and mesopic with glare. For each condition, patients were placed 2.4 m from the CSV-1000 retroilluminated (85 cd/m^2) translucent chart (VectorVision). For mesopic testing, patients were instructed to wear neutral density filtering glasses. Pupillometry was performed under

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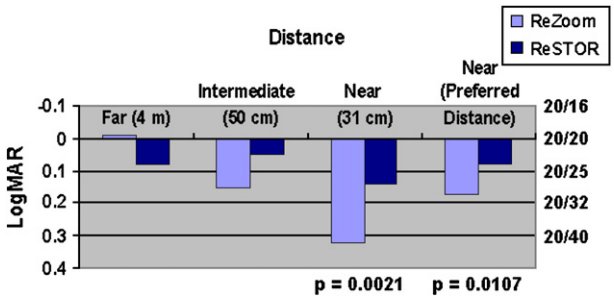

Figure 1. Uncorrected visual acuity at far, intermediate, and near.

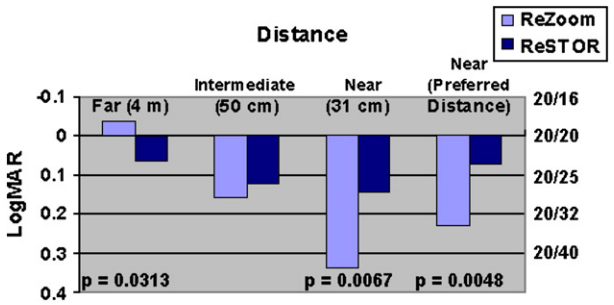

Figure 2. Best distance-corrected visual acuity at far, intermediate, and near.

photopic and mesopic lighting conditions using a Colvard pupillometer. The Titmus stereoacuity test was also administered 6 months postoperatively.

At the final study visit, patients completed the functional vision evaluation. This evaluation required patients to interact with props (eg, newspaper, menu, wall clock or calendar, laptop computer, medicine bottle, ingredient section of food wrapper) placed at varying distances (ie, near, intermediate, and far) throughout the room. For functional testing, patients wore their best distance spectacle correction to simulate emmetropia. The props, lighting, and room were standardized, and the same technician performed the functional vision evaluation in all cases.

A quality-of-life questionnaire was used to evaluate visual performance for several daily-life activities. The questionnaire was administered preoperatively and at all binocular postoperative visits and assessed spectacle freedom, reading comfort, and overall satisfaction. The questionnaire was self-administered via a computer web site at home (requiring Internet access) or in the investigator's office.

Statistical Analysis

Statistical analysis was performed by an independent biostatistician using the SAS system (version 9.1, SAS Institute). Between-group comparisons for numeric variables were by the Wilcoxon rank sum test. For categorical variables, the Pearson chi-square or Fisher exact test was applied where appropriate. All tests were 2 sided with a 95% confidence level.

RESULTS

The mean patient age in the ReZoom group was 64.9 years ± 6.1 (SD); 57.1% were women. The mean patient age in the ReSTOR group was 66.5 ± 8.0 years; 55.6% were women. The mean preoperative spherical equivalent (SE) was +0.41 D in the ReZoom group and −3.58 D in the ReSTOR group. The 6-month postoperative SE was −0.21 D and −0.03 D, respectively.

One patient in the ReSTOR group and 2 patients in the ReZoom group failed to complete the study. The patient in the ReSTOR completed the 1-month postoperative visit and was lost to follow-up before the 6-month postoperative visit. The 2 patients in the ReZoom group refused second IOL implantation, citing halo and glare problems. One of the 2 patients had the ReZoom IOL explanted approximately 3 months after the original surgery.

Six months postoperatively, the uncorrected distance acuity ($P = .1108$) and uncorrected intermediate acuity at 50 cm ($P = .0609$) were similar between the 2 groups. Best corrected distance acuity was statistically significantly better in the ReZoom group ($P = .0313$). The ReSTOR group had statistically significantly better uncorrected near acuity at 31 cm ($P = .0026$) and uncorrected near acuity at the patient's preferred distance ($P = .0107$) (Figure 1). With best distance correction, the ReZoom group performed statistically significantly better than the ReSTOR group at 4 m ($P = .0313$). The ReSTOR group performed significantly better than the ReZoom group at both near distances ($P = .0067$ at 31 cm and $P = .0048$ at patient-preferred distance) (Figure 2). Table 1 shows the mean visual acuities by group. Table 2 shows the mean monocular visual acuities 1-week after first-eye surgery.

Table 1. Mean binocular visual acuity by IOL type.

	ReZoom		ReSTOR		
Visual Acuity	Snellen	LogMAR	Snellen	LogMAR	*P* Value
Uncorrected					
Distance	20/20	−0.01	20/25	0.08	.1108
Intermediate (50 cm)	20/32	0.15	20/25	0.05	.0609
Near (31 cm)	20/40	0.32	20/25	0.14	.0026*
Near (patient preferred)	20/32	0.17	20/25	0.08	.0107*
Distance corrected					
Distance	20/20	−0.04	20/20	0.06	.0313*
Intermediate (50 cm)	20/32	0.16	20/25	0.12	.2993
Near (31 cm)	20/40	0.34	20/25	0.14	.0067*
Near (patient preferred)	20/32	0.23	20/25	0.07	.0048*

*Statistically significant

Table 2. Mean monocular visual acuity by IOL type 1-week after first-eye surgery.

	ReZoom		ReSTOR	
Visual Acuity	Snellen	LogMAR	Snellen	LogMAR
Uncorrected				
Distance	20/32	0.24	20/32	0.23
Intermediate (50 cm)	20/40	0.29	20/50	0.39
Near (31 cm)	20/63	0.46	20/50	0.35
Near (patient preferred)	20/32	0.21	20/40	0.32
Distance corrected				
Distance	20/32	0.17	20/32	0.17
Intermediate (50 cm)	20/32	0.22	20/50	0.37
Near (31 cm)	20/50	0.36	20/50	0.38
Near (patient preferred)	20/32	0.20	20/32	0.21

Contrast sensitivity scores were similar between the 2 groups, with 1 statistically significant difference per condition (photopic with and without glare, mesopic with and without glare). The ReSTOR group performed significantly better than the ReZoom group under photopic conditions at 6 cycles per degree (cpd) without glare, mesopic conditions at 6 cpd without glare, photopic conditions at 18 cpd with glare, and mesopic conditions at 12 cpd with glare. Tables 3 and 4 show the mean contrast sensitivity by group.

The mean photopic pupil size was statistically significantly greater in the ReSTOR group (4.45 mm) than in the ReZoom group (3.82 mm) ($P = .0023$). The mean mesopic pupil size was 4.75 mm in the ReZoom group and 5.33 mm in the ReSTOR group ($P = .0256$).

At the 6-month visit, the mean Titmus stereoacuity test score was 8.36 in the ReZoom group and 6.50 in the ReSTOR group, with 100% of patients and 74.1% of patients, respectively, achieving 80 seconds of arc or better. The differences between the groups were statistically significant ($P = .0170$).

With respect to near-distance functional vision evaluation props, the ReZoom group answered 83.3% of the questions correctly and the ReSTOR group, 93.1%. There were no statistically significant differences between the groups in magazine photo caption reading, nutrition bar ingredients, eyedrop bottle expiration date, medicine box dosage, or newspaper index ($P > .05$). The difference in correctly reading a newspaper stock price was statistically significant ($P = .0285$), with the ReSTOR group outperforming the ReZoom group. All patients in both groups answered the interactive intermediate and distance questions correctly.

Patients in both groups reported problems with nighttime vision, halos, and glare. Halo issues were cited by 66.7% of patients in the ReZoom group and 58.3% in the ReSTOR group. Figure 3 shows the severity of halos in each group. Glare difficulty was reported by 58.3% of patients in each group. Nighttime vision problems were reported by 66.7% in the ReZoom group and 25.0% in the ReSTOR group.

Spectacle freedom, as reported in the questionnaire, was achieved by 8 patients (50.0%) in the ReZoom group and 11 patients (72.7%) in the ReSTOR group. Although the observed difference was clinically significant, it did not reach statistical significance on the Fisher exact test ($P = .3765$) because of the small number of patients responding to this question. Figures 4 to 8 report spectacle freedom for specific tasks. Spectacle freedom was correlated with the patients' ratings of their current vision ($P = .0007$, Cochran-Mantel-Haenszel test controlling for IOL type). There was no significant difference between groups in patient satisfaction ($P = .8015$). On a scale of 1 to 10, the mean

Table 3. Mean contrast sensitivity without glare by IOL type.

	Mean ± SD		
Postop Variable	ReZoom	ReSTOR	*P* Value
Photopic contrast			
3 cpd	1.83 ± 0.20	1.84 ± 0.14	.8939
6 cpd	1.73 ± 0.20	1.89 ± 0.17	.0408*
12 cpd	1.53 ± 0.16	1.48 ± 0.35	.5672
18 cpd	1.18 ± 0.23	0.95 ± 0.30	.0587
Mesopic contrast			
3 cpd	1.68 ± 0.19	1.78 ± 0.12	.1015
6 cpd	1.81 ± 0.23	2.02 ± 0.18	.0237*
12 cpd	1.53 ± 0.16	1.52 ± 0.34	.7525
18 cpd	1.09 ± 0.16	1.01 ± 0.25	.6163

cpd = cycles per degree
*Statistically significant

Table 4. Mean contrast sensitivity with glare by IOL type.

	Mean ± SD		
Postop Variable	ReZoom	ReSTOR	*P* Value
Photopic contrast			
3 cpd	1.62 ± 0.20	1.76 ± 0.15	.0524
6 cpd	1.73 ± 0.17	1.82 ± 0.13	.1672
12 cpd	1.58 ± 0.16	1.41 ± 0.31	.2487
18 cpd	1.15 ± 0.16	0.81 ± 0.36	.0075*
Mesopic contrast			
3 cpd	1.60 ± 0.39	1.77 ± 0.12	.2488
6 cpd	1.82 ± 0.22	1.88 ± 0.15	.4523
12 cpd	1.52 ± 0.15	1.34 ± 0.29	.0481*
18 cpd	1.14 ± 0.19	0.98 ± 0.27	.1409

cpd = cycles per degree
*Statistically significant

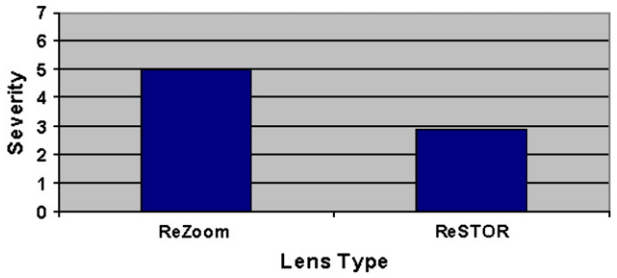

Figure 3. Mean patient-reported severity of halos on the quality-of-life questionnaire (7-point scale; 1 = minimal; 7 = severe).

satisfaction rating was 8.5 in the ReZoom group and 8.2 in the ReSTOR group. Two patients in the ReZoom group chose not to have the same IOL implanted in the second eye. The rest of the patients in that group and all patients in the ReSTOR group questioned at 6 months reported they would have the same IOL implanted. Table 5 shows spectacle freedom, patient satisfaction levels, and additional subjective and objective patient data.

DISCUSSION

The ability to test functional tasks adds credence to visual acuity outcomes and may be more aligned with patient expectations.[10–13] These measurements are especially important in light of the May 2005 decision of the Centers for Medicare and Medicaid Services to allow patients to pay out-of-pocket for presbyopia-correcting IOLs. Paying patients may expect best-case outcomes, including spectacle independence and excellent functional vision at all distances.[7] Using objective and subjective criteria, this prospective study evaluated clinical outcomes, spectacle freedom, and functional vision for the 2 competing multifocal IOL designs introduced in the U.S. during 2005.

Several studies have confirmed that multifocal IOLs can improve uncorrected acuity for a greater range of distances than monofocal IOLs, resulting in reduced spectacle dependence.[1,4,6,8] However, the correlation of Snellen measurements with daily function is not always direct or clear cut. Jaeger 4 near-card acuity, for example, does not tell whether patients are able to comfortably read the newspaper at a reasonable speed and without fatigue. This study, therefore, also analyzed subjective criteria; that is, the patient's self-reported independence or reliance on spectacles for several common daily tasks.

In an attempt to correlate the questionnaire responses, standardized office testing was devised to measure patients' ability to accurately read several household items at a variety of distances. Testing real-life tasks at multiple distances is important because multifocal IOLs are not expected to provide optimum focus across the entire range of functional distances. In addition, patients faced with selecting a multifocal IOL at additional cost are interested in its effect on activities of daily living as opposed to what clinical measures will be achieved. I believe this is the first study to directly compare these 2 multifocal IOLs using a combination of objective, subjective, and functional testing.

Such a comparison is particularly important now that surgeons and patients have a choice of 2 multifocal IOLs with different optical designs and effective add powers. The ReSTOR IOL produces the equivalent of a +3.2 D spectacle add, compared with +2.6 D with the ReZoom IOL. In addition, the relative performance of each multifocal IOL varies with pupil size. The ReZoom optic design is expected to provide minimal reading focus with a smaller pupil diameter ($\leq$2.0 mm). The ReSTOR optic is designed so that the proportion of distance focused light increases significantly with wider pupil diameters. This was intended to decrease the amount of ghosting and halos at night.

Because of these design differences, the choice of IOL was not randomized in this study. Instead, the investigator selected the multifocal IOL he believed would most meet the individual patient's needs in terms of function and tolerability. Patients with habitually shorter reading distances, such as myopic patients not currently wearing reading glasses, were more likely to receive a ReSTOR IOL because of the higher effective add. Patients with larger pupils were

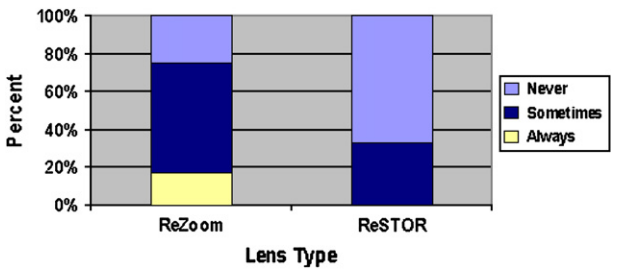

Figure 4. Patient-reported spectacle use for reading the newspaper.

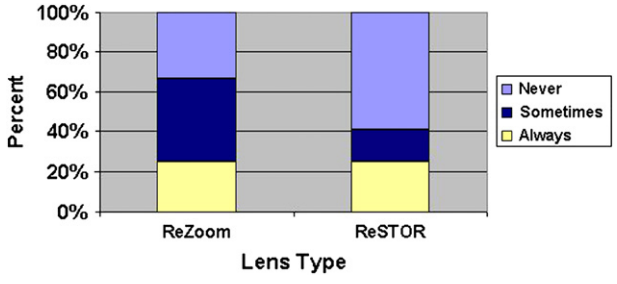

Figure 5. Patient-reported spectacle use for using a computer.

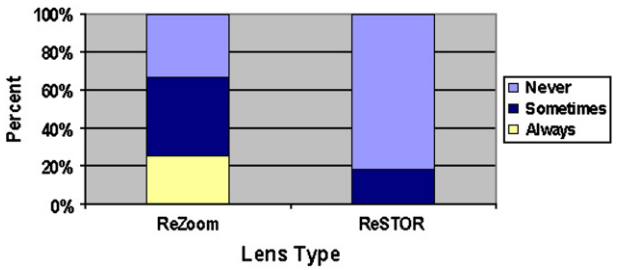

Figure 6. Patient-reported spectacle use for reading a menu in dim light.

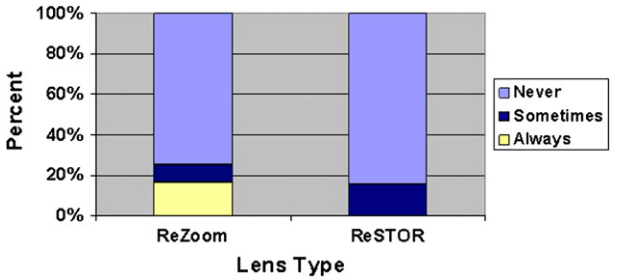

Figure 7. Patient-reported spectacle use for driving during the day.

also more likely to receive a ReSTOR IOL to lessen the likelihood of seeing halos while driving at night. These selection biases are reflected in the mean preoperative refractive error and pupil sizes in the 2 study groups. Preoperatively, the ReSTOR patients tended to be more myopic (mean SE −3.58 D) whereas the ReZoom patients were slightly hyperopic (mean SE +0.42 D). The mesopic pupil size was 4.75 mm and 5.33 mm in the ReZoom group and ReSTOR group, respectively ($P = .0256$). The option of mixing dissimilar multifocal IOL optics was not addressed in this study.

Another goal of the study was to make the results as clinically applicable as possible. Although the investigator had extensive experience with the Array multifocal IOL, the 30 patients enrolled represented his first 15 consecutive bilateral ReZoom patients and first 15 consecutive bilateral ReSTOR patients 70 years or younger. In contrast to FDA clinical trials, the study patients paid additional out-of-pocket fees to receive the multifocal IOL and concomitant astigmatic keratotomy could be performed at the surgeon's discretion. It was the investigator's goal to carefully select and personally counsel patients who were likely to be satisfied with their multifocal IOLs. The study patients, therefore, had healthy eyes aside from cataract, were motivated to see without glasses, anticipated bilateral implantation, and appeared to have reasonable expectations.

The 2 IOL groups were similar in age and sex ratio. An arbitrary age cutoff of 70 years was chosen to evaluate the performance of each multifocal IOL in the more demanding age bracket of a typical cataract practice. It was expected that younger patients would tend to drive more at night, which is an important consideration for how well patients might cope with halos and nighttime optical aberrations. Younger patients also tend to use computers more often, which is an important functional test of intermediate distance capability.

Finally, multifocal IOLs are designed with an emmetropic result in mind. Residual astigmatism, however, may reduce uncorrected vision at all distances, and residual myopia may improve near function with some IOL designs. Thus, targeting slight myopia in at least 1 eye is a common strategy with the Crystalens accommodating IOL (Eyeonics). To better compare the intrinsic pseudoaccommodative capabilities of the 2 multifocal IOLs, vision testing at all

Table 5. Objective and patient-reported results by IOL type.

Parameter	ReZoom*	ReSTOR
Functional test (% correct)		
Newspaper index	100	100
Newspaper stock price	67	100
Magazine photo caption	100	92
Eyedrop container expiration date	75	100
Medicine box dosage	58	67
Nutrition bar ingredients	100	100
Visual disturbances		
Incidence of halos (%)	67	58
Mean severity of halos (1–7)	5.0	2.9
Spectacle freedom (%)		
Reading a newspaper	25	67
Reading in dim light	33	82
Recognizing people's reactions	100	92
Using a computer	33	58
Doing fine handwork	33	50
Writing checks or bills	42	92
Cooking	58	91
Playing games	80	91
Participating in sports	75	100
Seeing steps, curbs, or stairs	92	92
Watching TV	83	92
Reading traffic signs	83	83
Driving during the day	75	83
Driving at night	73	83
Driving in the rain	75	83
Overall	50	73
Satisfaction		
Using a computer without difficulty (%)	50	70
Mean vision rating (1–4)	3.4	3.6
Mean satisfaction rating (1–10)	8.5	8.2
IOL again (%)	100	100

IOL = intraocular lens
*Two of 15 patients chose not to have a ReZoom IOL implanted in their second eye and were not part of this 6-month cohort.

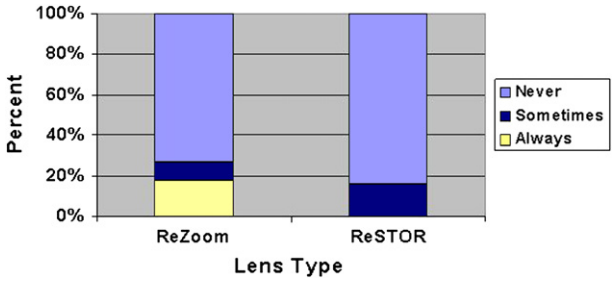

Figure 8. Patient-reported spectacle use for driving at night.

distances with best distance correction and without correction was performed.

Although the ReZoom group was slightly more myopic postoperatively, the ReSTOR group had better near vision (at 31 cm and at the patient-preferred distance) with both uncorrected and distance-corrected testing. The better near function in the ReSTOR group agrees with findings in the current literature.[7,9,14] It was also consistent with the functional vision evaluation, in which ReSTOR patients answered a higher percentage of questions correctly while viewing near props through their distance correction.

Suboptimal intermediate vision with the ReSTOR has been noted in the literature.[2,7,14] However, 2 other studies, by Chiam et al.[3] and Alfonso et al.,[5] found that 85% and 96% of ReSTOR patients, respectively, were spectacle free at intermediate distances. The FDA submissions report that 92.6% of ReZoom patients and 82.4% of ReSTOR patients had 20/40 or better acuity at intermediate distances without eyeglasses (AcrySof ReSTOR IOL Clinical Results. Available at: http://www.acrysofrestor.com/acrysof-restor-iol/restor-clinical-studies.asp. Accessed February 5, 2008; ReZoom package insert. Available at: http://www.rezoomiol.com/files/PackageInsert.pdf. Accessed February 5, 2008).

The results in this study indicate that the uncorrected and distance-corrected intermediate acuities with both IOLs are comparable when measured at 50 cm. Finally the quality-of-life questionnaire assessed the difficulty patients reported for selected intermediate-distance tasks without glasses. Approximately one fourth of patients in both groups reported always wearing eyeglasses when working on the computer. In the ReZoom group and the ReSTOR groups, respectively, 50.0% and 70.0% reported little to no difficulty using a computer and 50.0% and 81.8% had little to no difficulty writing checks. According to these subjective patient responses, intermediate-distance functionality for the 2 tasks was comparable and certainly not worse with the ReSTOR IOL.

The distance at which intermediate vision is tested varies between studies and ranges from 50 cm to 80 cm. The ReZoom package insert reports intermediate vision at 70 cm, and the ReSTOR package insert reports intermediate vision at 50 cm, 60 cm, and 70 cm. A testing distance of 50 cm was chosen for this study, a distance that corresponds to approximately 20 inches or the focal distance of a +2.0 D add. During the functional vision evaluation, the distance between the patient and the computer screen was recorded as an observational measure of preferred intermediate distance. The mean computer-to-patient distance was 53.1 cm in the ReZoom group and 44.0 cm in the ReSTOR group. From this information, it can be argued that a 50 cm testing distance is reasonable and corresponds with the functional intermediate-vision task of viewing a computer screen.

Near testing was performed at 31 cm, which corresponds to approximately 12 inches or the focal distance of a +3.0 D add. It is possible that selecting different testing distances for near and intermediate vision altered the clinical findings. Therefore, uncorrected and distance-corrected near testing was repeated at the patient's preferred reading distance, which the patient could select. The results in the ReSTOR group were still statistically better for near, indicating that the better reading performance in this group was not simply the result of using an arbitrary 31 cm testing distance.

The percentage of patients reporting halos was approximately 60% in both groups. The severity of halos was significantly worse in the ReZoom group however, and this correlated with greater self-reported difficulty with night driving despite a 6-month period of adaptation. Further highlighting the potential for more severe halo and glare was that 2 patients refused ReZoom IOL implantation in the second eye because of problems with nighttime vision. In both cases, the first eye with ReZoom IOL implantation was emmetropic (20/20 at distance and J1 at near), and the patients were otherwise happy with their uncorrected acuity. One patient had the ReZoom IOL explanted and exchanged at his request. The other patient waited 1 year before choosing an accommodating IOL for the second eye. The 6-month bilateral data analysis did not include these 2 patients.

Of the analyzed cohort (excluding the 2 dissatisfied ReZoom patients who did not complete the study and satisfaction survey), all patients were very satisfied with their vision and all would choose the same IOL again. The percentage of patients achieving spectacle freedom was only 50.0% in the ReZoom group and 72.7% in the ReSTOR group. That these percentages are lower than those previously reported may relate to the younger age of this study population. As stated, an objective of the study was to evaluate IOL performance in a younger segment of the cataract

population, which would be expected to be more demanding in terms of lifestyle and visual function.

That such high satisfaction scores were achieved despite so many patients requiring eyeglasses for some activities speaks to the importance of preoperative counseling and patient expectations. Particularly in light of the significant out-of-pocket costs, it is important that patients not choose these technologies with the expectation of being spectacle free. It should be emphasized that great care was taken to select patients with healthy eyes, low astigmatism, and realistic expectations; to carefully educate and counsel them; and to select a multifocal IOL that seemed most likely to fulfill the patients' functional needs.

In conclusion, both the ReZoom and ReSTOR multifocal IOL provided excellent uncorrected visual acuity across near, intermediate, and far distances when bilaterally implanted in younger cataract patients. In this prospective study, the ReZoom IOL provided slightly better distance acuity. The ReSTOR IOL, however, provided better uncorrected and distance corrected near acuity. Intermediate acuity at 50 cm was comparable in the 2 IOL groups, and approximately 25% of patients in both groups needed eyeglasses when using the computer. Although the frequency of reported halos was approximately 60% in both groups, the severity was much higher in the ReZoom group, in which 2 of the 15 patients refused to have a second ReZoom IOL implanted. Approximately 50% of ReZoom patients and 75% of ReSTOR patients were spectacle free, which may reflect the younger population selected for this study. Nevertheless, satisfaction rates were very high with both IOLs, suggesting that patient selection and expectations are a major determinant of postoperative satisfaction.

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